Title: Effects of Spatial Resolution on the Simulated Dust Aerosol Lifecycle: Implications for Dust Event Magnitude and Timing in the NASA GEOS-5 AGCM

Session: A36: Multi-sensor and Model Aerosol Data Inter-comparison and Synergy

Authors: E. Nowottnick, P. Colarco, A. da Silva

Abstract:

The NASA GEOS-5 atmospheric transport model simulates global aerosol distributions with an online aerosol module. GEOS-5 may be run at various horizontal spatial resolutions depending on the research application. For example, long integration climate simulations are typically run at 2° or 1° grid spacing, whereas aerosol reanalysis and forecasting applications may be performed at 0.5° or 0.25° resolutions. In this study, we assess the implications of varying spatial resolution on the simulated aerosol fields, with a particular focus on dust. Dust emissions in GEOS-5 are calculated with one of two parameterizations, one based on the Goddard Chemistry, Aerosol, Radiation, and Transport (GOCART) model and another based on the Dust Entrainment and Deposition (DEAD) model. Emission fluxes are parameterized in terms of the surface wind speed, either the 10-m (GOCART) or friction (DEAD) wind speed. We consider how surface wind speeds and thus the dust emission rates are a function of the model spatial resolution. We find that spatial resolution has a significant effect on the magnitude of dust emissions, as higher resolution versions of the model have typically higher surface wind speeds. Utilizing space-borne observations from MISR, MODIS, and CALIOP, we find that simulated AOT distributions respond differently to spatial resolution over the African and Asian source regions, highlighting the need to regional dust emission tuning. When compared to ground-based observations from AERONET, we found improved timing of dust events with as spatial resolution was increased. In an attempt to improve the representation of the dust aerosol lifecycle at coarse resolutions, we found that incorporating the effects of sub-grid wind variability in a course resolution simulation led to improved agreement with observed AOT magnitudes, but did not impact the timing of simulated dust events.